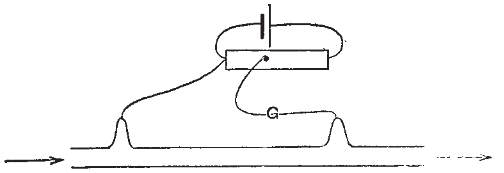
tions above mentioned are suitable for the measurement of such currents as 10 amperes.

Another method, available with the strong currents which are now common, depends upon Faraday's discovery of the rotation of the plane of polarisation by magnetic force. Gordon found 15°[1] as the rotation due to the reversal of a current of 4 amperes circulating about 1000 times round a column of bisulphide of carbon. With heavy glass, which is more convenient in ordinary use, the rotation is somewhat greater. With a coil of 100 windings we should obtain 15° with a current of 40 amperes; and this rotation may easily be tripled by causing the light to traverse the column three times, or, what is desirable with so strong a current, the thickness of the wire may be increased and the number of windings reduced. With the best optical arrangements the rotation can be determined to one or two minutes, but in an instrument intended for practical use such a degree of delicacy is not available. One difficulty arises from the depolarising properties of most specimens of heavy glass. Arrangements are in progress for a redetermination of the rotation in bisulphide of carbon.



RAYLEIGH

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

OXFORD.—In spite of the large majority in favour of the preamble of the statute allowing women to enter for certain University Examinations, the statute was again opposed on March 11, on being brought up by Council after amendment. After a lengthy debate, the statute was carried by 107 against 72. The chief arguments used against the measure were based on the alleged unfairness to men in allowing women to compete under no restrictions of time and residence, and for portions only of any examination; and on the evil to the health of women which might arise from their competing with men. Mr. Pelham, of Exeter, pointed out that the statute was not one to confer degrees upon women, but to make Oxford an examining body for the various centres of female education in England, and enable it to confer certificates which would have a recognised value. Mr. Sedgwick read letters from the heads of Newnham and Girton, at Cambridge, showing that the health of the students was excellent.

SCIENTIFIC SERIALS

THE *American Journal of Science*, February.—Examination of Alfred R. Wallace's modification of the physical theory of secular changes of climate, by James Croll. While agreeing with much that has been advanced by Wallace in his "Island Life," in explanation of geological climate, the author fails to perceive that any of the arguments or considerations there adduced materially affect his own theory as advocated in "Climate and Time." He still holds that with the present distribution of land and water, without calling in the aid of any other geographical conditions than now obtain, the physical agencies detailed in "Climate and Time" are sufficient to account for all the phenomena of the Glacial epoch, including those intercalated warm periods, during which Greenland would probably be free from ice, and the Arctic regions enjoying a mild climate.—Communications from the United States Geological Survey, Rocky Mountain division, No. v.; on sanidine and topaz, &c., in the nevadite of Chalk Mountain, Colorado, by Whitman Cross. The sanidine crystals contain gas inclusions, but no fluids, and the topaz, elsewhere found only in granite, gneiss, or other metamorphic or crystalline schists, here occurs in an eruptive rock probably of early Tertiary age.—On the occurrence of the Lower Burlington limestone in New Mexico, by Frank Springer. The observations made by the author in 1882 in the Lake Valley Mining District, Southern New Mexico, have brought to light numerous facts confirming the views of the Burlington geologists regarding the distinct character of the upper and lower subcarboniferous groups in that district, but demonstrating that the Lower Burlington limestone has a much wider geographical range than had hitherto been suspected.—The Minnesota Valley in the Ice Age (concluded, with two maps), by Warren Upham.—Glacial drift in Montana and Dakota, by Charles A. White. The author, who had already determined the presence of true northern Glacial drift in the region about the Lower Yellowstone River, now traces the same drift much further west. His observations were mainly confined to the Missouri Valley, but also reached to the vicinity of the Great Paw Mountains, extending for over a thousand miles at intervals from the Great Falls of the Missouri to Bismarck in Dakota.—Phenomena of the Glacial and Champlain periods about the mouth of the Connecticut Valley, that is, in the New Haven region (with two plates), by James D. Dana. The author concludes that during the Ice period the Mill River channel was excavated or deepened by glacier action. This channel, as it widened southwards below the mouth of the Pine Marsh Creek, became partly obstructed by sand-bars, which increased as the flood made progress, and ultimately merged in the wide terrace formation of the New Haven plain.—Supplement to paper on the paramorphic origin of the hornblende of the crystalline rocks of the North-Western States, by R. D. Irving.—On herderite, a glucinum calcium phosphate and fluoride from Oxford County, Maine, by William Earl Hidden and James B. Mackintosh.—Note on the decay of rocks in Brazil, by Orville A. Derby.

Bulletin de l'Académie Royale de Belgique, December 1, 1883.—Note on the presence of erratic boulders on the Belgian lowlands, by M. E. Delvaux. From the blocks of Scandinavian granites found at Limburg, in East Flanders, at Wachtebeke, and other places, the author concludes that during the Ice Age glaciation extended over the whole of the Netherlands, Belgium, and the shallow or exposed lands now flooded by the North Sea, terminating on the plains of Norfolk and Suffolk.—On amygdaline and germination, by M. A. Jorissen.—On the scintillation of the stars, in connection with the constitution of their light as revealed by spectrum analysis, by M. Ch. Montigny. The author's spectroscopic studies lead to the conclusion that those stars sparkle most whose spectra present the fewest bands, scintillation being weakest in those whose spectra are marked by broad dark bands.—On the fossil remains of *Sphargis rupeliensis* discovered in the brick clay of the Waas district, by P. J. van Beneden.—Note on a new differential dilatometer and its application to the study of the expansion of alums under the action of heat (one illustration), by W. Spring.—Some experiments on thin liquid layers of glycerine prepared from the oleate of sodium, by J. Plateau.—On the false appearances of aurora borealis observed in Belgium during the month of November 1883, by F. Terby.—Note on the anatomy and histology of a *Turbellaria rhabdocelis* (three illustrations), by P. Francotte.—On the laws regulating the proprietary rights of authors of musical and dramatical works in Belgium, by M. Cattreux.—An historical study of the reformer Froment and his first wife, Marie d'Ennetières, by M. Jules Vuij.—On a Society of Lawyers that flourished in Brussels during a great part of the eighteenth century, by Louis Hymans.—Remarks on the present state of music in the chief cities of Central Europe, by X. van Elewyck.—Generalisation of a property of surfaces of the second order, by M. Jamet.—Appearance of the satellites of Jupiter during the night of October 14, 1883, by F. Terby.—Note on the parallax of the sun deduced from the micrometric observations made at the Belgian stations during the transit of Venus on December 6, 1882, by means of specially constructed heliometers, by J. C. Houzeau.—Contributions to the history of the ovum; indirect relation of the germinative vesicle to the periphery of the vitellus (twelve illustrations), by Ch. van Bambeke.—Remarks on the study of biology and natural history in Belgium, by M. Ed. van Beneden.—On the salient features of the beds of the great marine basins, by M. A. Renard.

Atti della R. Accademia dei Lincei, December 16, 1883.—Notice of G. Orano's treatise on "Habitual Criminals," by S. Ferri.—On the causes of the retirement of the Alpine glaciers, by Roberto Paolo. The author concludes that the glaciers were developed under a mean summer temperature lower than at

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[1] January, 1884. In a note recently communicated to the Royal Society (*Proceedings*, November 15, 1883) Mr. Gordon points out that, owing to an error in reduction, the number given by him for the value of Verdet's constant is twice as great as it should be. The rotations above mentioned must therefore be halved, a correction which diminishes materially the prospect of constructing a useful instrument upon this principle.

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present, and that they are retreating not so much through cosmic or telluric causes as through meteorological changes depending partly on the prolonged action of man on the earth.—On the molecular velocities of gaseous bodies (continued), by Arnoldo Violi.—Experimental studies on Thapsia resin, by Francesco Canzoneri.—Distribution of the spots, faculæ, eruptions, and protuberances on the surface of the sun, deduced from the observations made at the Observatory of the Collegio Romano during the year 1882, by Pietro Tacchini.—Official return of the archæological discoveries made at Este, Bologna, Rome, Bolsena, Albano, and some other parts of Italy during the November of 1883, by S. Barnabei.—Meteorological observations made at the Observatory of the Campidoglio during the month of November, 1883.

January 6, 1884.—Notice of Prof. Carlo De Stefani's work on the "Lower Lias Formation of the Northern Alps," by S. Taramelli.—New determination of the optical characters of Christianite (anorthite) and Phillipsite (variegated copper ore), by Alfredo des Cloizeaux.—Note on the existence of two distinct optical axes in the Gismondine crystals (two illustrations), by the same author.—On the temperature corresponding to the Glacial period (continued), by Pietro Blaserna.—Some observations of the eighth satellite of Saturn, by E. Millosevich.—Meteorological observations made at the Observatory of the Campidoglio during the month of December, 1883.

Revue d'Anthropologie de Paris, No. 1, 1884, contains: Concluding part of Dr. P. Broca's "Description des Circonvolutions Cérébrales de l'Homme d'après le Cerveau Schématique," completed by Dr. Pozzi. The latter writer draws special attention to the third frontal circonvolution in man, which was first definitely shown by Broca to be the seat of the organ of speech. This function, in thirteen out of fourteen cases, is associated with the left frontal, and in one out of fourteen with the right frontal, as has been proved by loss of the faculty of speech, known as "aphasia," or, according to the writer, more correctly as "aphemia," which is due to lesions of that portion of the brain. Dr. Pozzi suggests that, in deference to the scientific importance of Broca's discovery, this special convolution should henceforth be distinguished by his name.—The continuation of M. Mathias Duval's lectures on "Le Transformisme," in which the writer treats specially of heredity and natural selection, drawing his materials, as in the earlier parts, almost exclusively from English sources.—"Les Cafres et plus spécialement les Zoulous," by Elie Reclus. This is the first of a series of papers intended by the author to elucidate the history of primitive peoples.

Rivista Scientifico-Industriale, Florence, December 15–31, 1883.—Account of the economic earthquake-warners constructed by the brothers Brassart of the Roman Central Meteorological Bureau (two illustrations), by E. Brassart.—De Tromelin's new aperiodical galvanometer.—On the electric resistance of porcelain, sulphur, and some other non-conducting substances.—On the measurement of electromotor forces.—On the determination of the work executed and absorbed by a dynamo.—Contribution to palæontological studies in Southern Italy, by Michele del Lupo.

Rendiconti del R. Istituto Lombardo, Milan, January 10, 1884.—On numbers irreducible by complex numbers (concluded), by Prof. C. Formenti.—Contribution to the physiology of the enteric juice, by Prof. L. Solera.—Clinical demonstration of a lymphatic infiltration of mechanical origin in the cornea; preliminary notice, by Dr. R. Rampoldi.—On the declaration of bankruptcy at the instance of the creditors, in the new Italian Commercial Code, by L. Gallavresi.—Attenuating and aggravating circumstances in the Criminal Code (concluded), by Prof. A. Buccellati.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, February 21.—"On an Explanation of Hall's Phenomenon." By Shelford Bidwell, M.A., LL.B.

Mr. E. H. Hall's papers, giving a full account of his well-known discovery, are printed in the *Philosophical Magazine* for March 1880, November 1880, September 1881, and May 1883. His original experiment was as follows:—A strip of gold leaf was cemented to a plate of glass and placed between the poles of an electromagnet, the plane of the glass being perpendicular to the magnetic lines of force. The current derived from a Bunsen cell was passed longitudinally through the gold, and, before the electromagnet was excited, two equipotential points were found by trial near opposite edges of the gold leaf, and about midway between the ends: when these points were connected with a galvanometer there was of course no deflection. A current from a powerful battery being passed through the coils of the magnet, it was found that a galvanometer deflection occurred, indicating a difference of potential between the two points, the direction of the current across the gold leaf being opposite to that in which the gold leaf itself would have moved across the lines of force had it been free to do so. On reversing the polarity of the magnet the direction of the transverse electromotive force was reversed; and when the magnet was demagnetised the two points reverted to their original equipotential condition.

Subsequent experiments showed that the direction of the effect differed according to the metal used. Thus with silver, tin, copper, brass, platinum, nickel, aluminium, and magnesium, the direction of the transverse electromotive force was found to be the same as in the case of gold: with iron, cobalt, and zinc the direction was reversed, and with lead there was no sensible effect in either direction.

Hall's results may be expressed by saying that the equipotential lines across the strip are rotated in a definite direction with respect to the lines of force. This effect was attributed by him to the direct action of the magnet on the current; and very great importance has been attached to the phenomenon in consequence of the opinion expressed by Prof. Rowland and others that it is connected with the magnetic rotation of the plane of polarisation of light, and thus furnishes additional evidence of an intimate relation between light and electricity.

A number of experiments made by the author convinced him, however, that no direct action of the kind supposed was ever produced, and he ultimately found that Hall's phenomenon might be completely explained by the joint action of mechanical strain and certain thermo-electric effects.

The strain is produced by electro-magnetic action. It will be convenient to refer to the metallic plate or strip (which for the purposes of this explanation may be assumed to be rectangular) as if it were an ordinary map, the two shorter sides being called respectively west and east, and the two longer north and south. Let the south pole of an electro-magnet be supposed to be beneath the strip, and let the strip be traversed by a current passing through it in a direction from west to east. Then the strip will tend to move across the lines of force in the direction from south to north. Since, however, it is not free to move bodily from its position, it will be strained, and the nature of the strain will be somewhat similar to that undergone by a horizontal beam of wood which is rigidly fixed at its two ends and supports a weight at the middle. Imagine the strip to be divided into two equal parts by a straight line joining the middle points of the west and east sides. Then in the upper or northern division the middle district will be stretched and the eastern and western districts will be compressed, while in the lower division the middle part will be compressed and the two ends will be stretched. If now a current is passing through the plate from west to east, the portion of the current which traverses the northern division will cross first from a district which is compressed to one which is stretched, and then from a district which is stretched to one which is compressed; while in the southern division the converse will be the case. And here the thermo-electric effects above referred to come into play.

Sir Wm. Thomson, in 1856, announced the fact that if a stretched copper wire is connected with an unstretched wire of the same material, and the junction heated, a thermo-electric current will flow from the stretched to the unstretched wire through the hot junction, while if the wires are of iron, the direction of the current is from unstretched to stretched. From this it might be inferred that a current would flow through the heated junction from an unstretched or free copper wire to a longitudinally compressed copper wire, and from a longitudinally compressed iron wire to a free iron wire; and experiment shows this to be the case. *A fortiori* therefore the direction of the current through the heated junction will be from stretched to compressed in the case of copper wire, and from compressed to stretched in the case of iron. If therefore a current is passed from a stretched portion of a wire to a compressed portion, heat will (according to the laws of the Peltier effect) be absorbed at the junction if the metal is copper and will be developed at the

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